NODC Environmental Information Bulletin No. 99-1

# Atlas of Surface Marine Data 1994
## (UWM/COADS Data)

**Collaboration between researchers** at the Department of Geosciences of the University of Wisconsin-Milwaukee (UWM) and the NOAA/National Oceanographic Data Center/Ocean Climate Laboratory (OCL), has culminated in the production of objective analyses of observed and derived surface marine parameters. These global analyses are based on individual observations found in the Comprehensive Ocean-Atmosphere Data Set (COADS) Release 1, complemented by an interim release for the 1980's. Results of the analyses are presented in the *Atlas of Surface Marine Data 1994*, a 6-volume series of printed atlases, depicting 49-year seasonal climatologies (1945-93), anomalies, and standard deviations of various quantities characterizing the surface marine climate.

### Data Overview

The analyses presented in the *Atlas of Surface Marine Data 1994* are derived from the individual observations found in Compressed Marine Reports - Product 5 (CMR-5) of COADS Release 1. Observations included in COADS/CMR-5 consist of reports of wind, air and sea surface temperature, sea level pressure, humidity, and present weather. In addition to the observations, COADS/CMR-5 provides metadata such as quality control flags and measurement type indicators. Although COADS/CMR-5 includes observations as far back as 1854, the analyses in the *Atlas of Surface Marine Data 1994* cover only the years 1945 through 1993.

### Organization

The multi-volume *Atlas of Surface Marine Data 1994* is organized into two main categories. The first category, in-depth documentation of the data set, is found in Volume 1. Besides describing all parameterizations, calculations, and analysis methods used in creating the data set, this volume discusses possible biases the COADS data may contain and explains the bias corrections employed. Other subjects discussed in Volume 1 are the constraining of heat and fresh water fluxes by oceanographic transport estimates, sampling and fair weather biases, surface layer formulation, equations for astronomical calculations (e.g., altitude of the sun), and NetCDF data access software. The second main category is graphical representation of the data set. Volumes 2 through 6 consist mainly of seasonal contour plots of climatology, standard deviation, and anomalies of the analyzed quantities. The quantities are organized according to parameter type.

The data files associated with the *Atlas of Surface Marine Data 1994* are available in both their analyzed and unanalyzed

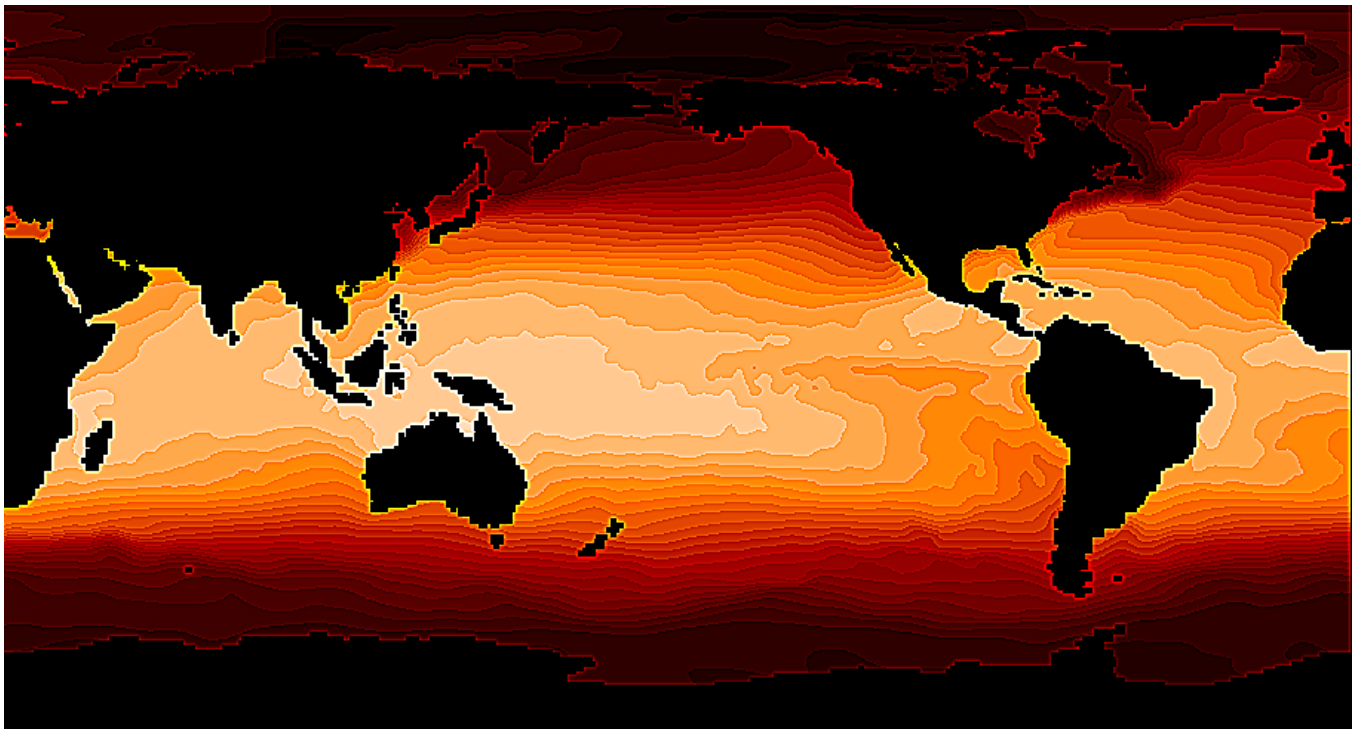

Figure 1. 1/2 degree SST climatology for January using the UWM/COADS data set.

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forms on CD-ROM. The majority of the analyzed quantities are contained in a set of nine CD-ROMs, organized by parameter type. Discs 1 through 5 contain monthly mean fields analyzed on a 1º by 1º global grid. The smallest wavelengths resolved are about 770 km. Data on discs 6 through 9 contain revised monthly and weekly mean fields computed and analyzed on a 0.5º x 0.5º grid. The smallest wavelengths resolved here are 386 km. Page 4 lists the CD-ROMs and quantities available on each disc.

On the CD-ROMs, the 12 analyzed monthly climatologies (1945-1989) and the 540 analyzed anomalies (12 months, 45 years) are stored in a single binary file for each quantity using Unidata's Network common Data Format (NetCDF). NetCDF allows access to binary files from most computer platforms, using a single set of FORTRAN or C subroutines. Easy-to-use FORTRAN access software is provided for those unfamiliar with NetCDF.

Number of observations per square are stored similarly. Standard deviation fields are stored in smaller files (12 monthly fields per file) also using NetCDF. Each anomaly or number of observations file is approximately 46 megabytes. The standard deviation files are a little more than 1 megabyte in size.

Unanalyzed data for each parameter is stored using NetCDF as well. An unanalyzed field contains the 12 monthly fields of mean, standard deviation, and number of observations for a single year. Information is stored for only those squares containing 1 or more observations during that month. While the size of these yearly files varies greatly, the total byte count for each parameter is around 150 megabytes. The unanalyzed data is available only by request and on a "1-off" (writeable) CD-ROM.

**Table 1:** List of objectively analyzed quantities in the UWM/COADS. Each file contains 12 monthly climatological grids and 540 monthly mean anomalies from January 1945-December 1989.

| **Directly Observed Quantities** |
|---|
| fractional cloudiness |
| specific humidity |
| air temperature at measurement height |
| sea level air pressure |
| sea surface temperature |
| zonal wind |
| meridional wind |
| wind speed |
| **Heat and Momentum Fluxes** |
| shortwave cloudiness sensitivity parameter |
| longwave $\chi$ sensitivity parameter |
| longwave vapor pressure sensitivity parameter |
| oceanic friction velocity cubed |
| latent heat flux |
| net long wave radiation |
| constrained net heat flux |
| sensible heat flux |
| net short wave radiation |
| zonal wind stress |
| meridional stress |
| **Fresh Water Fluxes** |
| constrained buoyancy flux |
| constrained evaporation minus precipitation |
| evaporation rate |
| precipitation rate |
| surface zonal moisture flux |
| surface moisture flux |
| **Miscellaneous Derived Quantities** |
| sea level air density |
| sea level specific humidity minus specific humidity |
| sea level specific humidity |
| relative humidity |
| sea minus air temperature |
| atmospheric zonal heat flux |
| atmospheric meridional heat flux |
| vapor pressure |
| virtual temperature |
| 10m/(Monin Obukhov length) |
| Ice masks and monthly salinity are also included. |

**Table 2:** List of raw (unanalyzed) quantities. There are 46 files consisting of 45 annual files from 1945-89 for each quantity, and a climatological file with computed statistics, including all of the data from 1945-89 for each month. Each annual/climatological file contains monthly means, standard deviations and number of observations for each calendar month.

| **Directly Observe Quantities** |
|---|
| fractional cloudiness |
| specific humidity |
| air temperature at measurement height |
| sea level air pressure |
| sea surface temperature |
| zonal wind |
| meridional wind |
| scalar wind |
| **Heat and Momentum Fluxes** |
| longwave $\chi$ sensitivity parameter |
| longwave vapor pressure sensitivity coefficient |
| oceanic friction velocity cubed |
| latent heat flux |
| net long wave radiation |
| sensible heat flux |
| zonal wind stress |
| meridional stress |
| **Fresh Water Fluxes** |
| evaporation rate |
| precipitation rate |
| surface zonal moisture flux |
| surface meridional moisture flux |
| **Miscellaneous Derived Quantities** |
| sea level air density |
| sea level specific humidity minus specific humidity |
| sea level specific humidity |
| relative humidity |
| sea minus air temperature |
| atmospheric zonal heat flux |
| atmospheric meridional heat flux |
| vapor pressure |
| virtual temperature |
| 10m/(Monin Obukhov length) |

See Table 1 for list of climatological statistics. Each file contains 12 monthly grids of climatology, standard deviation (n/a for quantities derived from analyzed fields), or interannual standard deviation (n/a for the sensitivity parameters.)

# ASMD Publications List:

**Atlas of Surface Marine Data 1994, Volume 01: Algorithms and Procedures.** (83 pp.) NOAA Atlas NESDIS 6. December 1994. Contains all of the documentation, methods, and discussion of the 1x1 degree data set **$19.00**

Volumes 2 through 6 contain brief discussions of the methods and seasonal plots of 1x1 degree climatologies, anomalies, standard deviation, and inter-annual standard deviation. (Note that Volume 1 does not contain the complete parameterizations for the quantities found in Volume 6.)

**Atlas of Surface Marine Data 1994, Volume 02: Anomalies of Directly Observed Quantities.** (416 pp.) NOAA Atlas NESDIS 7. August 1994. **$31.00**

Contains Sea Surface Temperature, sea level air temperature, sea level air pressure, specific humidity, zonal wind, meridional wind, scalar wind, fractional cloudiness

**Atlas of Surface Marine Data 1994, Volume 03: Anomalies of Heat and Momentum Fluxes.** (411 pp.) NOAA Atlas NESDIS 8. December 1994. **$55.00**

Contains latent heat flux, sensible heat flux, net longwave radiation, net shortwave radiation, constrained net heat flux, zonal wind stress, meridional wind stress, oceanic friction velocity cubed

**Atlas of Surface Marine Data 1994, Volume 04: Anomalies of Fresh Water Fluxes.** (308 pp.) NOAA Atlas NESDIS 9. December 1994. **$30.00**

Contains evaporation rate, precipitation rate, constrained evaporation minus precipitation, constrained buoyancy flux, surface zonal moisture flux, surface meridional moisture flux

**Atlas of Surface Marine Data 1994, Volume 05: Anomalies of Miscellaneous Derived Quantitites.** (416 pp.) NOAA Atlas NESDIS 10. December 1994. **$64.00**

Contains sea level air density and specific humidity, sea minus air specific humidity, relative humidity, SST minus SAT, vapor pressure, virtual temperature, Z/L, atmospheric zonal heat flux, atmospheric meridional heat flux

**Atlas of Surface Marine Data 1994, Volume 06: Heat Flux Sensitivity to Sea Surface Temperature.** (80 pp.) NOAA Atlas NESDIS 12. March 1997. **$15.00**

Contains constrained net heat flux sensitivity, latent heat flux sensitivity, sensible heat flux sensitivity, longwave radiation sensitivity, longwave vapor pressure term sensitivity, longwave $\chi$ term sensitivity

**Atlas of Surface Marine Data 1994, Supplement A: Anomalies of Directly Observed Quantities and Surface Marine Fluxes for 1990-1993.** (128 pp.) NOAA Atlas NESDIS 13. March 1997. **$15.00**

Contains an extension to the 1 x 1 degree anomalies for the years 1990 through 1993. Anomalies of selected observed quantities, heat fluxes, momentum fluxes, and fresh water fluxes are shown in the supplement.

**Atlas of Surface Marine Data 1994,Supplement B: Procedures For 1/2º x 1/2º Data Set.** (91 pp.) (NOAA Atlas NESDIS 17) October 1997. **$15.00**

Contains documentation specific to the 0.5 x 0.5 degree analysis, seasonal plot of monthly climatologies, and weekly plots of selected weekly climatologies. As this supplement presents some subjects in less than complete detail, Volume 1 should be consulted along with Supplement B.

- **Atlas of Surface Marine Data 1994**, Six volumes (NOAA Atlas NESDIS 6-10 and 12) **$214.00**
- **Atlas of Surface Marine Data 1994**, Supplements A & B (NOAA Atlas NESDIS 13 & 17) **$30.00**

# ASMD CD-ROM LIST:

**Atlas of Surface Marine Data 1994 Disc 01 (of 9) - Observed Quantities.** July 1995. $75.00
1x1 degree number of observations and analyzed climatologies and anomalies includes: fractional cloudiness, specific humidity, sea surface temperature, sea level air temperature, surface air temperature, sea level air pressure, corrected zonal wind, corrected meridional wind.

**Atlas of Surface Marine Data 1994 Disc 02 (of 9) - Heat, Momentum and Fluxes.** July 1995. $75.00
1x1 degree analyzed climatologies and anomalies includes: shortwave cloudiness sensitivity parameter, longwave χ sensitivity parameter, longwave vapor pressure sensitivity parameter, constrained buoyancy flux, evaporation rate, corrected latent heat flux, net longwave radiation, constrained net heat flux, precipitation rate, monthly salinity from Levitus, et al. (1994), corrected sensible heat flux, net short wave radiation, corrected zonal wind stress, corrected meridional stress.

**Atlas of Surface Marine Data 1994 Disc 03 (of 9) - Miscellaneous.** July 1995. $75.00
1x1 degree analyzed climatologies and anomalies include: sea level air density, constrained evaporation minus precipitation, ocean friction velocity cubed, sea level saturation specific humidity, relative humidity, sea minus air temperature, zonal moisture flux, vapor pressure, virtual temperature, meridional moisture flux, corrected wind speed, 10m/(Monin Obukov length)

**Atlas of Surface Marine Data 1994 Disc 04 (of 9) - Heat Flux Sensitivity.** May 1998. $75.00
1x1 degree analyzed climatologies and anomalies include: long wave vapor pressure term sensitivity, long wave χ term sensitivity, latent heat flux sensitivity, long wave radiation sensitivity, constrained net heat flux sensitivity, Sensible heat flux sensitivity

**Atlas of Surface Marine Data 1994 Disc 05 (of 9) - Anomalies 1990-1993.** May 1998. $75.00
1x1 degree number of observations and analyzed anomalies include: shortwave cloudiness sensitivity parameter, longwave χ sensitivity parameter, longwave vapor pressure sensitivity parameter, sea level air density, fractional cloudiness, constrained evaporation minus precipitation, evaporation rate, corrected latent heat flux, net longwave radiation, constrained net heat flux, precipitation rate, specific humidity, corrected sensible heat flux, net short wave radiation, sea level air pressure, sea surface temperature, sea minus air temperature, corrected zonal wind stress, corrected meridional stress, corrected zonal wind, vapor pressure

**Atlas of Surface Marine Data 1994 Disc 06 (of 9) - 0.5 Degree Analysis - Monthly.** May 1998. $75.00
0.5x0.5 degree analyzed monthly climatologies include: shortwave cloudiness sensitivity parameter, longwave χ sensitivity parameter, longwave vapor pressure sensitivity parameter, constrained buoyancy flux, fractional cloudiness, sea minus air temperature, vapor pressure, constrained evaporation minus precipitation, evaporation rate, ocean friction velocity cubed, corrected latent heat flux, net longwave radiation, constrained net heat flux, precipitation rate, specific humidity, sea level saturation specific humidity, relative humidity, sea level air density, corrected sensible heat flux, net short wave radiation, sea level air pressure, sea surface temperature, corrected zonal wind stress, corrected meridional stress, virtual temperature, corrected zonal wind, zonal sensible heat flux, zonal moisture flux, corrected meridional wind, meridional sensible heat flux, meridional moisture flux,corrected wind speed,10m/(Monin Obukov length)

**Atlas of Surface Marine Data 1994 Disc 07 (of 9) - 0.5 Degree Analysis - Weekly (1 ).** May 1998. $75.00
0.5x0.5 degree analyzed weekly climatologies include: fractional cloudiness, sea minus air temperature, vapor pressure, specific humidity, relative humidity, sea level air temperature, sea level air pressure, sea surface temperature, corrected zonal wind, corrected meridional wind, corrected wind speed

| **Atlas of Surface Marine Data 1994 Disc 08 (of 9) - 0.5 Degree Analysis - Weekly (2).** May 1998. $75.00
0.5x0.5 degree analyzed weekly climatologies include: shortwave cloudiness sensitivity parameter, longwave χ sensitivity parameter, longwave vapor pressure sensitivity parameter, ocean friction velocity cubed, corrected latent heat flux, net longwave radiation, constrained net heat flux, corrected sensible heat flux, net short wave radiation, corrected zonal wind stress, corrected meridional stress

| **Atlas of Surface Marine Data 1994 Disc 09 (of 9) - 0.5 Degree Analysis - Weekly (3).** May 1998. $75.00
0.5x0.5 degree analyzed weekly climatologies include: constrained buoyancy flux, constrained evaporation minus precipitation, evaporation rate, precipitation rate, sea level saturation specific humidity, sea level air density, virtual temperature, zonal sensible heat flux, zonal moisture flux, meridional sensible heat flux, meridional moisture flux, 10m/(Monin Obukov length)

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- **Atlas of Surface Marine Data 1994 - Complete set: 9 discs.** July 1995/May 1998. $675.00

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## ONLINE DATA ACCESS OPTIONS

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➢ Volume 1 of the ASMD 1994 is now online, courtesy of the Lamont-Doherty Earth Observatory of Columbia University:
http://ingrid.ldo.columbia.edu/documentation/dasilva/

➢Climatology and anomalies are available online as a result of the NOAA's Pacific Marine Environmental
Laboratory's "Access to Climate Data" project: http://ferret.wrc.noaa.gov/fbin/climate_server
Click on [Data Set] and then select [UWM/COADS: ...]
For on-line documentation of the data set, click on the [i] box.

➢The 1990-1993 extension is now available via anonymous ftp from niteroi.gsfc.nasa.gov (192.225.67.51), directory pub/uwm_coads. Follow the instructions provided in the README file found there. The directory structure is as follows:

| | |
|---|---|
| pub/uwm_coads/0.5x0.5/data/ | Data files (available upon request) |
| software/ | Access software |
| pub/uwm_coads/1x1/data/ | Data files |
| 1990-93/ | Anomalies for 1990-93 |
| ano/ | Selected anomaly files (1945-89) |
| clm/ | Climatological files (1945-89) |
| coards_clm/ | CARDS compliant climatological files (readable by GrADS and FERRET). |
| pub/uwm_coads/1x1/doc/ | Postscript files |
| software/ | Access software |

**NOTES:** 1. Only a very small subset of the data set is currently available on this ftp site.
2. The 1990-93 anomaly files require a new version of 'uwmcdf.f' and 'uwmcdf.h', available from 'pub/uwm_coads/1x1/software'.
3. The 1945-89 anomaly files also include the climatology.

Questions concerning these options may be directed to Arlindo da Silva, NASA/GSFC Data Assimilation Office, Code 910.3, Greenbelt, MD 20771. E-mail: dasilva@gsfc.nasa.gov

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